

Infineon Docket No. 2003P52882US
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WHAT IS CLAIMED IS:

1. A method of reducing skew between rising and falling data at an output node of a buffer circuit, comprising:

generating an intermediate voltage signal from an input voltage signal applied to an input node of the buffer circuit;

generating an output voltage signal at the output node based on the intermediate voltage signal; and

coupling at least one compensating current source to the output node to compensate for changes in at least one of a rate at which the output node is precharged and a rate at which the output node is discharged.

2. The method of claim 1, wherein coupling at least one compensating current source at the output node comprises coupling a first compensating current source between a supply voltage line and the output node to compensate for changes in NMOS current drive.

3. The method of claim 2, wherein coupling at least one compensating current source at the output node further comprises coupling a second compensating current source between the output node and ground to compensate for changes in PMOS current drive.

4. The method of claim 1, further comprising controlling the amount of current provided by the compensating current source via a process dependent current source whose current is mirrored by the compensating current.

5. The method of claim 4, further comprising controlling the amount of current supplied by the compensating current source via a relatively process independent bias voltage applied to a gate of a transistor of the process dependent current source.

Infineon Docket No. 2003P52882US
OC Docket No. INFN/0028
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6. A buffer circuit, comprising:

 a first stage for generating an intermediate voltage signal from an input voltage signal applied to an input node of the first stage;
 a second stage to receive the intermediate voltage signal and generate, on an output node of the second stage, an output voltage based on the intermediate voltage signal; and

 at least a first compensating current source coupled to the output node to compensate for changes in at least one of a rate at which the output node is precharged and a rate at which the output node is discharged.

7. The buffer circuit of claim 6, wherein the first compensating current source comprises:

 at least one current source that sources current into the output node; and
 at least one current source that sinks current from the output node.

8. The buffer circuit of claim 6, wherein the second stage comprises an inverter formed by a PMOS transistor and an NMOS transistor and the first compensating current source comprises a first current source to supplement current flowing into the output node through the PMOS transistor as function of NMOS current drive.

9. The buffer of claim 8, wherein changes in current provided by the first current source are proportional to changes in current through the NMOS transistor.

10. The buffer circuit of claim 8, further comprising at least a second current source to supplement current flowing from the output node through the NMOS transistor as function of PMOS current drive.

11. The buffer circuit of claim 6, wherein the second stage comprises an inverter formed by a PMOS transistor and an NMOS transistor and the first compensating current source supplements current flowing from the output node through the NMOS transistor as function of PMOS current drive.

12. The buffer of claim 11, wherein changes in current provided by the first compensating current source are proportional to changes in current through the PMOS transistor.

13. A buffer circuit, comprising:

a differential amplifier stage for generating an intermediate voltage signal indicative of the voltage difference between a reference voltage signal and an input voltage signal applied to an input node of the differential amplifier stage;

an inverter stage for generating, on an output node, an output voltage signal based on the intermediate voltage signal, wherein the inverter stage comprises at least one PMOS transistor and at least one NMOS transistor; and

at least a first current mirror circuit having a first branch and a second branch coupled to the output node, wherein current flowing through the first branch is dependent on changes in at least one of NMOS or PMOS current drive and current flowing through the second branch mirrors the current flowing through the first branch.

14. The buffer circuit of claim 13, wherein:

current flowing through the first branch of the first current mirror circuit varies with changes to NMOS current drive; and

current flowing from the second branch of the first current mirror circuit supplements current flowing into the output node through the PMOS transistor.

15. The buffer circuit of claim 13, wherein:

current flowing through the first branch of the first current mirror circuit varies with changes to PMOS current drive; and

current flowing into the second branch of the first current mirror circuit supplements current flowing from the output node through the NMOS transistor.

Infineon Docket No. 2003P52882US
OC Docket No. INFN/0028
Express Mail No. EV331235083US

16. The buffer of claim 15, further comprising at least a second current mirror circuit having a first branch and a second branch coupled with the output node, wherein:

current flowing through the first branch of the second current mirror circuit varies with changes to NMOS current drive; and

current flowing from the second branch of the second current mirror circuit supplements current flowing into the output node through the PMOS transistor.

17. The buffer circuit of claim 13, wherein the current flowing through the first branch of the first current mirror circuit is set by a process independent bias voltage supplied to a gate of a process dependent transistor.

18. The buffer circuit of claim 13, wherein the second branch of the first current mirror circuit comprises an NMOS transistor in parallel with the NMOS transistor of the inverter stage.

19. The buffer circuit of claim 13, wherein the second branch of the first current mirror circuit comprises a PMOS transistor in parallel with the PMOS transistor of the inverter stage.

20. A memory device, comprising:

an input to receive an external clock signal; and
a buffer circuit for generating an internal clock signal to be provided to one or more components of the memory device, wherein the buffer circuit comprises a first stage for generating an intermediate voltage signal indicative of a difference between a reference voltage signal and the clock signal, a second stage for generating an output voltage signal on an output node based on the intermediate voltage signal, an inverter for generating the internal clock signal based on the output voltage signal, and at least one compensating current source coupled to the output node to compensate for changes in at least one of a rate at which the output node is precharged and a rate at which the output node is discharged.

Infineon Docket No. 2003P52882US
OC Docket No. INFN/0028
Express Mail No. EV331235083US

21. The memory device of claim 20, wherein the at least one compensating current source comprises:

at least one current source that sources current into the output node; and
at least one current source that sinks current from the output node.

22. The memory device of claim 20, wherein the second stage comprises an inverter formed by a PMOS transistor and an NMOS transistor and the at least one compensating current source comprises a first current source to supplement current flowing into the output node through the PMOS transistor as function of NMOS current drive.

23. The memory device of claim 22, wherein the at least one compensating current source further comprises a second current source to supplement current flowing from the output node through the NMOS transistor as function of PMOS current drive.

24. The memory device of claim 20, wherein the second stage comprises an inverter formed by a PMOS transistor and an NMOS transistor and the at least one compensating current source comprises a first current source to supplement current flowing from the output node through the NMOS transistor as function of PMOS current drive.